

Innovative cybernetic approach in learning process

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Abstract. The study is based on the concept of shaping students' self-organisation in the digital learning environment of a technical university. The recommendations for creating an effective learning system can be used in the creation of effective education systems. They will be created through the use of digital technologies in the educational process of the university to create a culture of self-organization of students. According to these provisions, the author of the work should identify the characteristics of educational activities and ensure their effective implementation during the formation of the culture of students of a technical university. Scientific research on students' self-organization culture formation will be carried out considering the specifics of students' interaction and information environment of the university. The direction of the project approach in pedagogy is "pedagogical planning". The authors have identified the stages of pedagogical planning necessary for successful implementation of the project methodology and the problem under the study. They are necessary in the formation process of university students' self-organization culture. To conduct the research, it is necessary to determine the way in which the ability to create a culture of self-organization in the digital educational environment of a technical university can be developed. The authors have set a goal to provide students with the opportunity to realize their creative potential, to form self-organization. To enable students to design projects independently, the authors suggest that they show their autonomy in designing. They plan means to organize an effective learning process and ensure its effectiveness, which in modern conditions is possible through the introduction of digital technologies in the educational process of the university to create self-organization of students. The article describes technological methods of students' self-organization culture formation in the conditions of digital educational environment of a technical university, namely, project technologies, which are based on the relationship of a teacher and a group.

1 Introduction

The global science and technology civilization of the 21st century inevitably boosts all spheres of human activity and pushes education towards transformations. Social institutions in highly developed societies cannot respond fast to snowballing needs of the population. Enhancing development, science and technology civilization and modern global environment are in dire need of creative and forward-looking young professionals, who will be forged to meet social demands. This gap can only be leveled by a new methodological platform in education.

The modern civilizational era, from the point of view of human achievements, is considered anthropogenic, forming fundamentally new foundations of being and existence. The new format of civilization determines the emergence of new strategic goals, and ideologies and requires the development of appropriate methods and methods of implementation. The current historical situation strongly dictates the need to provide a philosophical justification and pedagogical support for a new ideological paradigm within the framework of a new type of humanism. [1, p. 4] The innovative creative potential of a person forms the contours of an anthropogenic civilization, broadcasting the continuity of the best qualities that were formed in a person in the

process of evolution. These qualities still make up the essence of the fullness of the individual and personal achievements today - these are freedom, responsibility, economic calculation, pragmatism, mutual assistance, etc. The scope of the content of the term "humanism", from the point of view of new realities, no longer corresponds to the traditional understanding of it only as philanthropy. The authorship of the creative principle, the synthesis of figurative and logical thinking, creativity, multimedia, and interactivity, combined with humanitarianism based on continuity and distance, give a holistic view of the humanism of the 21st century. The emergence of new principles of the humanism of the information society in the space of post-industrial globalism creates the preconditions for the creation of a new type of person, which can be conditionally called a "practitioner". Making the transition from a mass person of industrial civilization to a practical person, it is necessary to develop a new pedagogical concept, updating the content and methods of its implementation in the education perimeter [2].

The paper assumes that modern innovative society cannot avoid transformations in education, which updates the idea of integrating modern information technologies into learning policies. Economics and politics attribute competitive advantages to the rapid progression of science and education.

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A.A. Akhayan believes that modern reality complicates the essential principle of the student as a subject inscribed in the information format of society. Diffusion from the real to the ideal, from the ideal to the virtual becomes more complicated. A new reality appears - this is virtuality, a new, more complex dimension of a person appears - a virtual dimension. The infinite space of signs and meanings, the rhizome of thinking determines a special intellectual reflection. The new existence of a person at the prerequisite level creates a wide range of opportunities from the formation of a new individuality to serious risks. It is impossible to underestimate the significance of the negative and harm to health from digital technologies, which can pose a danger to the creative activity of a person ("children of the figure") [3].

M.P. Karpenko, a well-known domestic thinker in teaching and education, believes that educology is a modern science that thinks of "new applications of digitalization and e-learning technologies designed to drive up rates of growth, and relevance of learning processes in mass culture [4, p. 78].

The changing environment increasingly calls upon a new paradigm in education, a new rhetoric in education and a teaching model based on heuristic theories and fitting into it, new methodological tools [5, p. 127]. To accommodate this inquiry, a new science is being framed within educational research – that is, educology that aligns with an innovative style of thinking triggered by the industrial and cultural revolution of the twentieth century. The unique features of modern scientific progress has synthesized and intertwined diverse scientific, engineering, industrial, informational, and cultural processes. Growing information flows are reconfiguring society, influencing not only the production and storage of knowledge. Science itself becomes a way, part of a methodological toolkit designed to develop a new image of the world, store, accumulate and process information.

Besides shaping new thinking, information today seeks to ensure the survival of mankind, putting the traditional system of humanistic values at its core. The anthropological revolution of the 21st century forms the consciousness of a person living in a coordinated system of changing time, fast pace, dynamics, and rhythm. The new worldview, reflected in culture, dictates the need to form the appropriate qualities of a person built into a rapidly changing life. The new education will create a person with socially demanded qualities such as "cognitive navigation". "Cognitive navigation" is a key quality of a person, which gives impetus to the inclusion of a person in cognitive projects, allows inspiring and motivating for creative activity, perceiving oneself as a structural element of collective intelligence.

The usual toolkit of techniques could not fully save humanity from civilizational disasters, epidemics, and wars. Educology as a new methodological tool that develops a volatile individual, his/her progressive thinking, is more capable of providing prospects for essential human lives. Globally, a new concept of

educology, its methodological opportunities in synthetic unity, are called upon to develop new strategies to solving pressing problems. A platform is being created to enhance the student's intellectual potential to determine and choose the optimally effective solution, among a variety of possible goals. It is the possibilities of the cybernetic approach in pedagogy that form competencies that will allow us to apply useful information and predict the appropriate intellectual reaction leading to the achievement of the goal. The scientific potential of Cybernetics will make it possible to create a holistic information picture of the world, based on the synergy of organization and purposefulness. Management and feedback are important components of the process of obtaining new knowledge and connecting natural, social, humanitarian, and technical sciences.

Learning technologies increasingly include cybernetics that at a fundamentally new level makes a path to solve urgent problems in education. The goals and objectives of pedagogy come from the globalization trends. Namely, the methods of solution are developed by science, the role of which has been growing in recent decades. [6, p. 294]

2 Materials and Methods

We aim to explore a cybernetic methodological method promoted by educology as special knowledge about modern education of the 21st century. The paper deals with the cybernetic approach welcomed by globalized civilization in the information society and the digital economy. The paper focuses on the cybernetic potential rich in modern knowledge about the anthroposphere and noosphere, synergetic data. The teaching resource in interdisciplinary sciences looks at the learning procedure as an integral phenomenon, as non-linear systemic and structural changes. The study is aimed at the methodological potential of the cybernetic approach in the modern science of education referred to as educology, its specific features and prospects of its managerial arsenal.

Research methods are conditioned by the topic of this paper. The cybernetic approach of the new paradigm of education can be analyzed through the philosophical method to comprehensively approach the methodological foundations of cybernetics as a research method, educational processes, and ways to manage them. The structural and functional method comprehensively explores the interdisciplinarity of the method, its functionality in the education system, its structural components. The system approach is concerned with holism and integrity, internal consistency and scientific potential of the cybernetic method.

3 Results and Discussion

The term "cybernetics" was first introduced into the world of science by Andre-Marie Ampere in his seminal 19th century writing *Essay on the Philosophy of Sciences*. Cybernetics emerged as a theoretical science dealing with systems of governance and power

to provide citizens with a variety of benefits. Later, in 1948, Norbert Wiener viewed cybernetics “as a science that studies general laws and processes to control and transmit information flows in society, technology and living things.” [7, p. 17]

The construct of science is made up of mechanisms for studying communication processes, both feedback and black boxes, as well as derived concepts of synergy of control of living things, technology, and society. It provides insights into the core of digital, mechanical or biological artifacts. Based on a recorded fact, it processes the information received, correlates changes, makes predictions and offers optimal frames for effective solutions. Through a philosophical approach, it proposes several alternative solutions to issues or recommendations for additional revision of some components. Stafford Beer viewed cybernetics as the science of effective organization. Gordon Pask expanded the term by including limitless resourcefulness of information flows into the search perimeter, the scope of interests touched upon astronomy, astrology, the underwater world, the human brain, etc.

In 1956, the English thinker Louis Couffignal developed the definition of cybernetics in its philosophical understanding as “a creative act that ensures the effectiveness of actions.” [8, p. 83] Lewis Kaufman represented cybernetics as a science that studies the system and processes of a self-developing environment with interacting elements. [8, p. 20]

Methods of cybernetics are used to study phenomena of a system, in which there are some changes that are seen come and go in feedbacks and that affect the behavior of the system. “Feedback loops” are investigated by the methods of cybernetics.

From 1941 to 1960, led by Frank Fremont-Smith, the Josiah Macy Jr. Foundation hosted the Macy Conferences that brought together eminent scientists in interdisciplinary research. The main goal of the Macy Conferences was to promote constructive interaction between scientists from different spheres of science and ensure the unity of the scientific world. The ideological basis of cybernetics studies is to provide impetus to interdisciplinary research, expanding to embrace the diverse “spheres of management systems, the theory of electrical circuits, mechanical engineering, mathematical modeling, astronomy, synergetics, mathematical logic, evolutionary biology, craneology, neuroscience, cultural anthropology, control theory, systems theory and philosophy”. [9]

The scope of interests ascribed to cybernetics includes controllable non-material systems that fuel the artificial environment of the “cybernetic system” and its congruent “cybernetic approach”. A cybernetic system is composed of microsystems such as biological populations, automatic controllers in technology, electronic computer, human brain, society, etc. System elements are capable of perceiving and fixing information, memorizing, exchanging and processing data. Summarizing as much as possible, cybernetics can come up with the theory of governing social

systems and the practice of regulating the automated processes for cognitive neuropsychology.

Great expectations are attributed to the opportunities offered by cybernetics for studying psychological and pedagogical components in education. Modern domestic scientists show scientific interest in this dimension and deal with the formation of an effective model of the education system, applying a cybernetic approach to the pedagogical branch of social and humanitarian knowledge. It is impossible to ignore the studies of V.E. Firstov, A.Zh. Asainova, D.Yu. Belanov, G.M. Breslav, W.Ch. Kim, N.M. Komarova, Ya.Ya. Reimand, E.G. Rozanova, who are optimistic about the future and have high hopes for the possibilities and prospects for the convergence of cybernetics and pedagogical sciences. Nevertheless, the pedagogical intellectual community reacts critically to the arguments put forward by the proponents of the cybernetic method, fearing the likelihood of “de-ideologization of pedagogical science” [10]. The polemic about the prospects and innovations encouraged by the cybernetic approach gradually attracts more supporters who strongly emphasize the promising potential of interdisciplinary technology and synergy. [11]

The framework of pedagogical cybernetic tasks includes the search for fundamentally new methods and techniques for managing educational systems, controlling information flows. Mathematical modeling, within the framework of cybernetics, is becoming the main method of subject-subject approach in the learning process. Having delved into the idea of the resource and perspective base of cybernetics both as a science and as a methodological basis, V.S. Cherepanov structured the fundamental sections of pedagogical cybernetics. The structural elements of the methodological system of cybernetics involve “pedagogical qualitology and qualimetry (scientific disciplines on the methodology for assessing the quantity and quality of objects of any nature). Through a philosophical perspective of qualitology as a methodological tool we can observe the formation of the methodological and ideological field of student’s personality, as well as to trace the development and measurement of quality. Cybernetic methods are crucial in predicting the quality of informatization of education. Automation of search, training and control systems is at the heart of distance learning, its monitoring and psychodiagnostics. Within a new method in education being a new scientific direction, cybernetics will be used to control and effectively manage education and student intellectual assets. Both at the theoretical and practical levels, the methods of cybernetics and IT can be very productive in managing teaching and learning systems. [12]

It is noteworthy that the unit of information can be measured. Moreover, measurability of information can be comprehended, interpreted, predicted and, hence, can be applied in governing educational flows. Therefore, mathematical modeling as a cybernetic method is applicable in modeling a new conceptual model of the theory of education. Whereas, it seems logical that the potential and essential resource of the cybernetic

approach is to develop mathematical algorithms and identify patterns in the framework of teaching practices, its implementation into the education process to achieve the goals and personality development.

The prospect of human development is closely connected with the formation of cybernetic consciousness. The phenomenon of human consciousness is universal, in fact, and unique, a phenomenon characteristic of each person individually, manifested in his individuality. Cybernetic consciousness as a phenomenon is part of the noosphere of the global world in the information space. As the highest manifestation of the intellectual activity of the subject, cybernetic pedagogy will develop a methodological platform for the formation of a special type of consciousness, corresponding to the challenge of the time. The integrity of the cybernetic model of education integrates the human psyche, artificial intelligence, and mind into a single synergistic consciousness. The framework of which includes the ability to reflect the imaginary and the real, the virtual and the objective.

By integrating programming into the structure of cybernetic approach supported by psychological pedagogy, it is possible to develop a promising concept of step-by-step improvement of mental actions in the educational environment. The concept of “cybernetic pedagogy” is attached to this process. Now, education takes a cyber system (the concept of artificial intelligence) as a consistent way of recognizing images of didactic information and a purposeful process of mastering educational material [13], for predicting, creating a new one, recognizing similarity, drawing an analogy between heterogeneous objects and different teaching areas [14]. In the information society, the mission of the cybernetic method implies the cumulative use of a pool of innovative methods for managing educational processes in education institutions. This method creates a highly efficient coordination system based on advanced information technologies [15, p. 12]. A research vector indicates the direction to ensure the maximum effectiveness of distance and electronic technologies and emphasize the importance of cybernization and automated management of learning process. Based on hybrid intelligence, it is necessary to increase the flow of electronic textbooks and massively integrate smart learning.

4 Conclusion

With the advent of the fifth information revolution in the new millennium, cyberevolution, being a qualitatively new stage in the civilizational progression, gained impetus pushing for new transformations in all areas of the global environment. A new global network, otherwise referred to as cyberspace, has emerged. The novel information environment encompasses a system of information and technical infrastructures, the structural elements of which are the spheres of information, communication and computer. [16] The

above spheres are geared directly to store process and update data.

Consequently, cyberspace can serve as an important aid to foster the development of student personality during studies in the 21st century. The potential of cyberspace fully ensures the vertical growth of primary sources of educational literature and technology-driven renewal of educational methods based on civilizational values. Cybernetics, through maximum generalization, develops a methodological concept for managing social systems and automation processes in cognitive neuropsychology. [17] There is much hope that great opportunities promised by cybernetics would facilitate the studies of psychological and pedagogical components in the process of education. The ideological basis of studies in cybernetics is to promote interdisciplinary research.

Cybernetic methods in the new concept of pedagogy (educology) are a resource-based approach employed for studying the processes of managing teaching flows, which is based on information and mathematical modeling.

However, given the range of possibilities of cybernetics, controlling the thought processes of the individual, using special methodological tools, one should carefully observe the balance in the pedagogical process. It is necessary to harmonize in the minds of students such ontological phenomena as reality and cyberreality. To form an understanding of the processes that arise in the learning process: the assimilation of information from over-subject areas of knowledge in the process of acquiring intellectual experience, to stimulate and develop reflection in the framework of comprehending the cultural meanings of modernity.

Thus, in a fast-moving environment, it is necessary to apply and widely disseminate the cybernetic approach to enhance learning processes, which is a pluralism of heterogeneous elements exchanging interconnected and multidirectional information flows. [18] A performance indicator for management and organization of teaching and learning process is the ability to achieve the maximum level of students' progress in a short time. A well-chosen methodological principle can provide good results.

References

1. M.N. Nevzorov, *Pedagogical Humanities*, Part two. (Vladivostok-Ussuriysk, RADODAR, Publication House of FEFU, 2017)
2. A.A. Popov, *Open Education. Philosophy and Technology* (Moscow, LENAND, 2017)
3. A.A. Akhayan, Pedagogical problems of the era of the information society, *Electronic Scientific Journal* **2** (2014)
4. M.P. Karpenko, *Educology* (Association of E-learning (AEL), Moscow, 2020)
5. E.N. Syusyuka, Mathematical dependencies for calculating trajectory of mobile machine tool when processing ship shafting, *Operation of Maritime Transport* **4(97)** (2020)

6. E.G. Serdyuk, Effect of information on self-determination of personality, *Science, Education, Youth: Development Horizons. Proceedings of 2nd National Scientific and Practical Conference Kerch* (2022)
7. G.N. Povarov, *Ampere and Cybernetics* (Soviet Radio, Moscow, 1977)
8. L. Couffignal, *Cybernetics is the Art of Control* (Foreign Literature, Moscow, 1963)
9. A.V. Nikitin, *Cyberbiological synevolution (Cyberevolution)* (Volgodonsk, 2021)
10. N.F. Talyzina, *Management of Knowledge Mastery* (Moscow State University, Moscow, 1975)
11. T.V. Ezhova. *Theoretical Foundations of Computer Learning Management* (Information Technologies in Education, Moscow, 2019)
12. V.S. Cherepanov, *Fundamentals of Pedagogical Expertise* (ISTU, Izhevsk, 2006)
13. M. Bongard, *The Problem of Recognition* (Nauka, Moscow, 1967)
14. N.T. Abramova, *Cybernetics and Theorization of Scientific Knowledge* (Synthesis of knowledge, 1978)
15. V.V. Popov, *Education in the Light of Liberal Space Development and Transition to Cyberspace, Telecommunications, and Informatization of Education* (Moscow, 2005)
16. R.V. Mayer, *Cybernetic Pedagogy: Simulation Modeling of the Learning Process* (Glazov State Ped. Institute, Glazov, 2014)
17. L.V. Yablonskaya, *Educology as a Resource Science of Modern Education. Innovations in Science and Education: Collection of Scientific Articles of the International Scientific-Practical Conference of the International Scientific-Practical Conference* (Moscow Pedagogical State University, Moscow, 2021)
18. Z.O. Kozyr, A.N. Tomilin, Pedagogical conditions of educational potential in the process of distance learning of college cadets, *The world of science, culture, and education*, **5(96)** (2022)